

SCH-MGMT 663 Supply Chain Analytics

Homework 6

Q.1 A manufacturer of cat towers wishes to locate a super assembly facility to meet their cat tower assembly needs for the next millennium. Currently, carpet, cylinders, yarn and fasteners are purchased in bulk from suppliers in North Haverbrook, Ogden, and Springfield in the quantities shown in the table. The super assembly facility would ship to distribution centers located in Seattle, Lubbock, Nashville, and Philadelphia. The locations of all of these cities on an x-y grid, transportation costs on a ton per mile basis, and total tonnage are all contained in the excel table.

Solution:

1. COG (Center of Gravity) Method:

- Facility Coordinates (\bar{X} , \bar{Y}): (571.6, 766.7)
- Total Cost: \$2,593,135.65

2. Solver-Based Optimization:

- Optimal Coordinates: (550.6, 808.3)
- Total Cost: \$2,586,342.18

3. Commentary on Solution Quality: While the COG method provides a good estimate based on distances and weights, the Solver approach yields a more accurate solution by minimizing the actual transportation costs across all sources and markets. The Solver solution led to a slightly lower total cost (by \$6,793), highlighting its precision in capturing all relevant cost parameters.

Q.2 Drylce, Inc., is a manufacturer of air conditioners that has seen its demand grow significantly. The company anticipates nationwide demand for the next year to be 180,000 units in the South, 120,000 units in the Midwest, 110,000 units in the East, and 100,000 units in the West. Managers are designing the manufacturing network and have selected four potential sites: New York, Atlanta, Chicago, and San Diego. Plants could have a capacity of either 200,000 or 400,000 units. The annual fixed costs at the four locations are shown in the next table, along with the cost of producing and shipping an air conditioner to each of the four markets. (For detailed data please see the excel file.)

Solution:

1. Where should the company build its factories?

The company should build factories in: New York, Atlanta, San Diego

The Chicago location should not be used as it does not contribute to minimizing total cost.

2. What capacity should each factory have?

Plant Location	Capacity Chosen	Fixed Cost
New York	200,000 units	\$6,000,000
Atlanta	200,000 units	\$5,500,000
San Diego	200,000 units	\$6,100,000

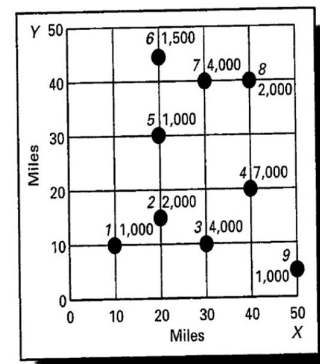
3. What is the best plan to meet demand for the created factories?

From \ To	East	South	Midwest	West
New York	180,000	0	20,000	0
Atlanta	0	120,000	80,000	0
San Diego	0	0	10,000	100,000
Chicago	0	0	0	0

This allocation ensures full demand coverage across all regions at the lowest total cost of \$129,420,000, while optimizing production and transportation efficiency.

Q.3 Suppose that Farmers' Bank wishes to serve the nine customer clusters as shown in the Figure below, where the potential number of customers in each cluster is reported.

It has proposed locating a branch (A) at coordinates $X_1 = 20$, $Y_1 = 20$. A competing branch (B) is located at coordinates $X_2 = 40$, $Y_2 = 30$. Farmers' Bank is to be a full-service branch with a relative size (attractiveness) index of 1. The competing branch is a partial-line facility (no ATM, no drive-through capabilities) with a size index of 0.7. The travel time for customers to a bank is approximated as $T(\text{hours}) = D/50$, where D = distance in miles. The average customer generates \$100 in gross annual revenue for a



bank. The estimate of annual operating expense for Farmers' Bank is \$300,000, and the facility will cost \$650,000 (20-year life) on land worth \$100,000.

Solution:

1. Branch Setup:

- Proposed Branch A: (20, 20), Attractiveness = 1.0
- Competitor Branch B: (40, 30), Attractiveness = 0.7
- Distance-based attraction calculated using Huff Model ($\alpha = 2$)

2. Financial Overview:

Metric	Branch A (Farmers')	Branch B (Competitor)
Revenue (1st Year)	\$1,178,573.97	\$1,171,426.03
Operating Expense	\$300,000	N/A
Net Profit	\$878,573.97	\$871,426.03
Payback Ratio (Year 1)	0.85	0.86
Total Investment(Facility + Land)	750000	

3. Decision:

Yes, Farmers' Bank should proceed with the construction of the branch. It demonstrates high revenue potential, excellent payback ratio, and a slight competitive advantage despite the presence of a rival. The project appears financially viable.

4. Further Considerations:

Huff's model is a powerful predictive tool that helps estimate how customers might choose between bank branches based on location and size, but it doesn't tell the whole story. While it gives us a solid starting point for understanding potential revenue and market share, real customer decisions are influenced by much more—like loyalty, service quality, convenience, and even how well they know the brand. It also doesn't consider things like real-world traffic, the rise of online banking, or how many competitors are truly in the area. So before making a final decision, it's important to pair the model's insights with a deeper understanding of the local community, customer behavior, and the practical realities of setting up and running a new branch.